CLAIMS

1.   A method for caching specified data of a primary storage main memory in an n-way set associative memory with a copy-back update policy, said associative memory comprising a plurality of rows, each row comprising n ways, said method comprising:

selecting a row of said associative memory according to an address of said specified data;

if a first way of said selected row comprises invalid data, caching said specified data in said first way and discontinuing said data caching process; and

if all of said n ways of said selected row comprise valid data, performing the steps of:

i. selecting a second way of said selected row according to a first predetermined replacement strategy;

ii. if said second way comprises unmodified data, caching said specified data in said second way and discontinuing said data caching process;

iii. if said second way comprises modified data, and if at least one of said ways comprises data from a currently open page of said main memory, caching said specified data in a way comprising data from said currently open page and discontinuing said data caching process; and

iv. if said second way comprises modified data, and if none of said n ways of said selected row comprise data from said currently open page of said main memory, caching said specified data in said second way.

2.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 1, wherein said main memory comprises a DRAM (dynamic random access memory).

3.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 1, wherein said first predetermined replacement strategy comprises a least recently used (LRU) replacement strategy.

4.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 1, further comprising:

if, in step iii, a single way of said selected row comprises data from said currently open page, caching said specified data in said single way and discontinuing said data caching process; and

if, in step iii, a plurality of ways of said selected row comprise data from said currently open page of said main memory, performing the steps of:

> selecting a third way from amongst said plurality of ways according to a second predetermined replacement strategy;
>
> caching said specified data in said third way; and
>
> discontinuing said data caching process.

5.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 4, wherein said second predetermined replacement strategy comprises a least recently used (LRU) replacement strategy.

6.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 1, further comprising updating a current page indicator to indicate the currently open page of said main memory.

7.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 1, further comprising locking a way so as to prevent data caching in said locked way.

8.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 1, further comprising writing data replaced in said associative memory to said main memory.

9.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 1, further comprising writing data replaced in said associative memory to a buffer memory.

10.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 1, further comprising analyzing a tag and row of a specified way to substantially determine if said specified way comprises data from said currently open page.

11.   A method for caching specified data of a primary storage main memory in an n-way set associative memory with a copy-back update policy, said associative memory comprising a plurality of rows, each row comprising n ways, said method comprising:

i. selecting a row of said associative memory according to an address of said specified data;

ii. if at least one of said ways comprises data from a currently open page of said main memory, caching said specified data in a way comprising data from said currently open page and discontinuing said data caching process;

iii. if none of said n ways of said selected row comprise data from said currently open page of said main memory, performing the steps of:

> selecting a first way of said selected row according to a first predetermined
>
> replacement strategy; and
>
> caching said specified data in said first way.

12.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 11, wherein said main memory comprises a DRAM.

13.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 11, further comprising:

> if a second way of said selected row comprises invalid data, caching said specified

data in said second way and discontinuing said data caching process.

14.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 11, wherein said first predetermined replacement strategy comprises a least recently used (LRU) replacement strategy.

15.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 11, further comprising:

if, in step ii, a single way of said selected row comprises data from said currently open page, caching said specified data in said single way and discontinuing said data caching process; and

if, in step ii, a plurality of ways of said selected row comprise data from said currently open page of said main memory, performing the steps of:

selecting a third way from amongst said plurality of ways according to a second
predetermined replacement strategy;

caching said specified data in said third way; and

discontinuing said data caching process.

16. A method for caching specified data of a primary storage main memory in an
n-way set associative memory according to claim 15, wherein said second predetermined
replacement strategy comprises a least recently used (LRU) replacement strategy.

17. A method for caching specified data of a primary storage main memory in an
n-way set associative memory according to claim 11, further comprising updating a current
page indicator to indicate the currently open page of said main memory.

18. A method for caching specified data of a primary storage main memory in an
n-way set associative memory according to claim 11, further comprising locking a way so as
to prevent data caching in said locked way.

19. A method for caching specified data of a primary storage main memory in an
n-way set associative memory according to claim 11, further comprising writing data
replaced in said associative memory to said main memory.

20. A method for caching specified data of a primary storage main memory in an
n-way set associative memory according to claim 11, further comprising writing data
replaced in said associative memory to a buffer memory.

21. A method for caching specified data of a primary storage main memory in an
n-way set associative memory according to claim 11, further comprising analyzing a tag and
row of a specified way to substantially determine if said specified way comprises data from
said currently open page.

22. A method for caching specified data of a primary storage main memory in an
n-way set associative memory with a copy-back update policy, said associative memory

comprising a plurality of rows, each row comprising n ways, associative data storage, said method comprising:

selecting a row of said associative memory according to an address of said specified data;

if a first way of said selected row comprises invalid data, caching said specified data in said first way and discontinuing said data caching process; and

if all of said n ways of said selected row comprise valid data, performing the steps of:

i. analyzing said main memory to determine a main memory status;

ii. selecting a second way of said selected row for caching in accordance with said main memory status; and

iii. caching said specified data in said second way.

23. A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 22, wherein analyzing said main memory status comprises determining a currently open page of said main memory.

24. A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 22, wherein said main memory comprises a DRAM.

25. A way selector system, comprising a way selector for selecting a way for the caching of specified data of a primary storage main memory in an n-way set associative memory with a copy-back update policy, said associative memory comprising a plurality of rows, each row comprising n ways, wherein said associative memory comprises a fast memory for caching main memory data for easy external access, and wherein said specified data for caching originates from said main memory and from external agents connected to said main memory via said associative memory, said way selector comprising:

an invalid data detector, for detecting a way of a selected row comprising invalid data;

a replacement selector, for selecting a way of said selected row according to a first predetermined replacement strategy;

an open page identifier, for identifying a way of said selected row comprising data from a currently open page of a main memory; and

an analyzer, associated with said invalid data detector, said replacement selector, said modified data detector, and said open page identifier, for choosing one of said n ways for data replacement.

26. A way selector system according to claim 25, wherein said main memory comprises a DRAM.

27. A way selector system according to claim 25, further comprising a row selector, for selecting a row of said associative memory according to an address of said specified data.

28. A way selector system according to claim 25, further comprising a modified data detector, for detecting if a way of said selected row comprises modified data.

29. A way selector system according to claim 25, wherein said open page identifier comprises a page detector for analyzing a tag and row of a specified way to determine a main memory page associated with data stored in said way.

30. A way selector system according to claim 25, further comprising a current page indicator for indicating the currently open page of said main memory.

31. A way selector system according to claim 25, further comprising a secondary selector for selecting a way from amongst a plurality of ways comprising data from said currently open page of said main memory according to a second predetermined replacement strategy.

32. A way selector system according to claim 25, wherein said first predetermined replacement strategy comprises a least recently used (LRU) replacement strategy.

33. A way selector system according to claim 31, wherein second predetermined replacement strategy comprises a least recently used (LRU) replacement strategy.

34. A way selector system according to claim 25, comprising a way locker for locking a way so as to prevent data caching in said locked way.

35. A way selector system according to claim 25, comprising a data cacher for caching said specified data in said chosen way of said selected row.

36. A way selector system according to claim 25, comprising an n-way set associative memory.

37. A way selector system according to claim 25, comprising a buffer memory for storing the data replaced in said associative memory prior to writing said replaced data to said main memory.

38. A way selector system according to claim 25, further comprising strategy selector for selecting an application-specific first replacement strategy.

39. A way selector system according to claim 38, wherein said strategy selector is further operable to select an application-specific second replacement strategy.

40. A way selector system, comprising a way selector for selecting a way for the caching of specified data of a primary storage main memory in an n-way set associative memory with a copy-back update policy, said associative memory comprising a plurality of rows, each row comprising n ways, wherein said associative memory comprises a fast memory for caching main memory data for easy external access, and wherein said specified data for caching originates from said main memory and from external agents connected to said main memory via said associative memory, said way selector comprising:
an open page identifier, for identifying a way of a selected row comprising data from a currently open page of said main memory;
a replacement selector, for selecting a way of said selected row according to a predetermined replacement strategy; and
an analyzer, associated with said replacement selector and said open page identifier, for choosing one of said n ways for data replacement.

41.   A way selector system, comprising a way selector for selecting a way for the caching specified data of a primary storage main memory in an n-way set associative memory with a copy-back update policy, said associative memory comprising a plurality of rows, each row comprising n ways, wherein said associative memory comprises a fast memory for caching main memory data for easy external access, and wherein said specified data for caching originates from said main memory and from external agents connected to said main memory via said associative memory, said way selector comprising:

a main memory status checker, for monitoring main memory status;

an analyzer, associated with said main memory status checker, for choosing one of said n ways for data replacement.

42.   A method for caching specified data of a primary storage main memory in an n-way set associative memory with a copy-back update policy, said associative memory comprising a plurality of rows, each row comprising n ways, said method comprising:

selecting an application-specific first replacement strategy;

selecting a row of said associative memory according to an address of said specified data;

if a first way of said selected row comprises invalid data, caching said specified data in said first way and discontinuing said data caching process; and

if all of said n ways of said selected row comprise valid data, performing the steps of:

    i. selecting a second way of said selected row according to said first replacement strategy;

    ii. if said second way comprises unmodified data, caching said specified data in said second way and discontinuing said data caching process;

    iii. if said second way comprises modified data, and if at least one of said ways comprises data from a currently open page of said main memory, caching said specified data in a way comprising data from said currently open page and discontinuing said data caching process; and

    iv. if said second way comprises modified data, and if none of said n ways of said selected row comprise data from said currently open page of said main memory, caching said specified data in said second way.

43.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 42, further comprising selecting an application-specific second replacement strategy.

44.   A method for caching specified data of a primary storage main memory in an n-way set associative memory according to claim 43, further comprising:

if, in step iii, a single way of said selected row comprises data from said currently open page, caching said specified data in said single way and discontinuing said data caching process; and

if, in step iii, a plurality of ways of said selected row comprise data from said currently open page of said main memory, performing the steps of:

selecting a third way from amongst said plurality of ways according to a second replacement strategy;

caching said specified data in said third way; and

discontinuing said data caching process.